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METHOD OF STERILIZING AIR

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This invention relates to methods of sterilizing air by means of vapors.

Attempts have been made to sterilize air by means of liquid aerosols, but these have not proved to be completely satisfactory. In so far as we are aware, complete and instantaneous sterilization of air by means of vapors derived from generally non-germicidal materials has not heretofore been accomplished.

The liquid aerosols of the prior art consist of solutions of germicidal agents dispersed in minute droplet form. The most effective of these are resorcinol and hexyl resorcinol. In preparing these prior art aerosols, the germicidal agents were preliminarily dissolved in a suitable solvent and the solutions then atomized to form droplets of the desired size. The solvents used were water, benzyl alcohol, benzyl benzoate, cyclohexanol, methylated spirits, alcohol, glycols, glycerine and like suitable vehicles or carriers for the desired germicidal agents.

The air sterilization effectiveness of these prior art aerosols, when disseminated throughout an enclosed space, was considered to be entirely dependent upon the germicidal agent used. Most of these germicidal agents are objectionably toxic and hence their use is extremely limited. The most effective ones, resorcinol and hexyl resorcinol, also possess a certain degree of toxicity and may produce objectionable local and systemic effects when inhaled over long periods of time.

Incidental attempts to sterilize air by means of liquid aerosols formed from alcoholic solutions of propylene glycol have been made. We have found that propylene glycol, in the concentrations named, is incapable of effecting any substantial or instantaneous sterilization of air. The results obtained by these prior art workers appear to be due to the presence of the alcohol in vapor form. These prior art workers (Twort et al., Jour. Hygiene, 40:253, 1940) did not recognize the need for a lethal dose of the glycol in vapor form in the air. In fact, they labored under the misapprehension that "a molecular dispersion, i. e. a vapour, is ineffective" to sterilize air.

In accordance with our invention, we have found that the glycols themselves, in vapor form, are capable of effecting complete and instantaneous sterilization of a bacteria-laden atmosphere, including an atmosphere laden with pathogenic invaders of the respiratory tract. We have found that small amounts of a glycol in vapor form in an atmosphere containing as many as 150,000 to 250,000 bacteria per liter of air, and even more, has a 100% lethal action on the bacteria. In addition, this lethal action takes place with surprising rapidity, in most cases substantially instantaneously and in others in a period in the order of only a few seconds.

Any of the glycols such as diethylene glycol, 1,3, butylene glycol and trimethylene glycol may be used in accordance with our invention, but we prefer ethylene glycol, propylene glycol and 2,3, butylene glycol. Propylene glycol is particularly preferred because of its superior sterilizing activity and apparent low toxicity and because it can be inhaled for some time without producing any undesired local or systemic effects. The sterilizing glycol vapors have a prolonged sterilizing action, in fact of indefinite duration where the concentrations of vapors in the air are maintained as hereinafter described.

In the sterilization of air in a chamber, room, or other enclosed space with glycol vapors in accordance with our invention, the liquid glycol, for example propylene glycol, is vaporized in any desirable manner as by heat or by bubbling air through a body of the glycol, and the glycol vapors are then introduced into the enclosed space and permitted to intermingle with the air therein. The vapors may be introduced into the enclosed space in any desirable manner as through a conduit. Thus, they may be sprayed, pumped or blown into the enclosed space. If desired, the vapors may be generated within the space. The quantity of glycol vapors introduced into the space may vary as hereinafter described, and their sterilizing effectiveness is independent, within wide limits, of the number of bacteria in the air.

A minimum quantity of the glycol vapors should be introduced into the chamber, sufficient to instantaneously kill the bacteria in the air. As a matter of ordinary precaution, particularly where complete sterilization is desired, a slight excess should be introduced.

In some instances we have found that complete and substantially instantaneous air sterilization may be effected by the introduction of as little as about 1 gram of propylene glycol, for example, in vapor form, in about 10 to about 15 million cubic centimeters of air under normal conditions of temperature and pressure, dependent to some extent on the resistance of the bacteria. This same amount of glycol vapor is capable of sterilizing even larger volumes of air, say about 20 to about 30 million cubic centimeters; however, in such dilutions the lethal action of the vapors on the bacteria is not always substantially instantaneous. Even in more extreme dilutions